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2013 Nonresidential Downstream Deemed ESPI Net-to-Gross Evaluation For Sprinkler and Pipe Insulation Measures

Prepared for
California Public Utilities Commission

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2013 Net-to-Gross Evaluation of Sprinkler and Pipe Insulation Measures

This report documents the net-to-gross (NTG) analysis undertaken by the Nonresidential Downstream Deemed ESPI Impact Evaluation of the 2013 investor-owned utilities' (IOU) energy efficiency programs for pipe insulation and sprinkler measures. The overall goal of this study is to develop ex-post net-to-gross ratios (NTGRs) for these two specific nonresidential deemed measures that were identified in the Efficiency Savings and Performance Incentive (ESPI) decision[1].

This report discusses the researchable issues, information on the measure groups evaluated as well as the data sources used, the approach for sampling, and the method used to determine ex-post NTGRs. Finally, the report presents the results and findings from the analysis and updates the ex ante NTGRs to estimate net first year and lifecycle ex post savings for the pipe insulation and sprinkler measures.

1.1 Goals and Objectives

The objective of this study is to develop NTGRs for sprinkler and pipe insulation measures, utilizing new primary evaluation data, in order to update existing net savings estimates and inform future savings values for the measures studied. Attachment 2 of the ESPI decision provides an overview of the portfolio parameters that have been identified as potentially requiring ex-post verification, which includes NTGRs.

To meet this objective, phone interviews were conducted with a sample of 2013 sprinkler and pipe insulation participants in order to assess free ridership and estimate NTGRs. These NTGRs could then be applied to ex-ante gross savings values to estimate ex-post net first year and lifecycle savings values.

[1] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF

1.2 Overview of Measures Studied

This study is a component of the larger Nonresidential Downstream Impact Evaluation Work Order[2]. The ESPI decision lists, in Attachment 3, a number of deemed nonresidential measures that are subject to some level of ex-post evaluation for the 2013 program year, which includes the following two measures that are the focus of this report:

- Sprinklers (low pressures nozzles and micro conversions)
- Pipe Insulation (hot and cold applications)

Table 1-1 presents both measures' contribution to each Program Administrator's (PA's) 2013 portfolio kW and kWh energy savings[3] (as well as the statewide contribution).

Table 1-2 presents the therms savings associated with the pipe insulation measure for 2013. Because the cold application pipe insulation measure contributed such a small level of electric savings towards the overall portfolio, this measure was not evaluated.

Table 1-1: Pipe Insulation and Sprinkler kWh and kW Savings – Expressed as a Percentage of the PA's 2013 Portfolio Gross Ex-Ante Savings

	2013 kWh Savings				2013 kW Savings			
Measure Group	**SW**	**PG&E**	**SCE**	**SDG&E**	**SW**	**PG&E**	**SCE**	**SDG&E**
AG IRRIGATION SPRINKLERS	1.1%	2.4%	0.0%	0.0%	4.4%	9.5%	0.0%	0.0%
PIPE INSULATION COLD APPLICATION	0.0%	0.1%		0.0%	0.1%	0.1%		0.0%

Table 1-2: Pipe Insulation Therm Savings – Expressed as a Percentage of the PA's 2013 Portfolio Gross Ex-Ante Therms Savings

	2013 Therms Savings			
Measure Group	**SW**	**PG&E**	**SCG**	**SDG&E**
PIPE INSULATION HOT APPLICATION	1.8%	0.5%	4.3%	1.1%

1.3 Phone Survey Sample Design and Data Collection

A phone survey was conducted to support the NTG analysis. The phone survey was designed to also recruit customers for onsite visits that will support a gross impact evaluation for both measures that will be conducted to support the program year 2014 ESPI impact evaluation. The

[2] Work Order ED_I_COM_1.

[3] These savings don't include those associated with Codes and Standards

detailed sample design is discussed in the 2013-14 Nonresidential Downstream Deemed ESPI Impact Evaluation Research Plan[4]. As discussed in the research plan, the sample focused on sites in PG&E and SCG territories as these two PA's comprised 99% of all hot application savings. Therefore, only PG&E and SCG hot application pipe insulation participants were sampled for this evaluation. Similarly, 99.8% of all sprinkler savings occurred in PG&E's territory and over 70% of that savings was associated with portable sprinkler measures (as opposed to permanent). Therefore, the evaluation focused this segment of the sprinkler population so that only PG&E portable sprinkler participants were sampled.

Pipe Insulation

Table 1-3 summarizes the sample design for hot application pipe insulation along with the actual number of phone surveys completed, which was stratified by boiler type and project size, in terms of the magnitude of therm savings. The sample frame includes PG&E and SCG hot application participants from program year 2013 and the first two quarters of 2014 to increase the sample frame (population) from which the sample was drawn. The sample design of 30 completed phone surveys was expected to achieve in the neighborhood of a 90/10 relative precision, based on an expected COV of 0.30 based on the results of the 2010-12 Nonresidential Downstream Lighting Impact Evaluation NTGR results[5].

[4] http://www.energydataweb.com/cpucFiles/pdaDocs/1210/PY2013-2014%20Deemed%20ESPI%20Research%20Plan_PDA.pdf

[5] The NTGR approach for pipe insulation and sprinkler measures utilizes the same methodology as that employed for the 2010-12 Nonresidential Downstream Lighting Evaluation. That evaluation found that NTGRs did not vary much by lighting technology, but did vary somewhat by program delivery mechanism. More importantly, the COV around these estimates was consistent across both technologies and delivery mechanisms. For these reasons, it was felt that the average COV from the 2010-12 Nonresidential Downstream Lighting Evaluation would serve as a reasonable estimate for the purposes of estimating the sample design for both pipe insulation and sprinklers.

Table 1-3: Pipe Insulation Sample Design and Achieved Data Collection by Boiler Type and Project Size – PY2013 and Q2 PY2014

Boiler Type	Project Size (Therms)	Percent of Ex-Ante Savings	Population*	Sample Design	Actual Completed Surveys
Hot Steam	> 25,000	38%	6	6	3
Hot Steam	10,000 - 25,000	21%	15	7	7
Hot Steam	< 10,000	16%	57	7	4
Hot Water	> 25,000	9%	3	3	1
Hot Water	10,000 - 25,000	8%	7	4	3
Hot Water	< 10,000	6%	26	3	0
Total		**99%**[6]	**103**	**30**	**18**

*The population column sums up to more than the total because some participants installed multiple measures across various strata.

Only 18 participants out of a sample frame of 103 agreed to conducting the phone survey, so the target sample size of 30 was not met. However, the 18 participants do represent 41% of the ex ante Therm savings claim. The sample size of 18 resulted in a relative precision of 16%, which is not significantly out of range of what was targeted.

Sprinklers

The sample design for sprinklers focused on PG&E's territory as they contributed almost all (99.8%) of the statewide savings for this measure. Because over 70% of the savings was associated with portable sprinkler measures (as opposed to permanent), the evaluation also focused on the portable sprinklers. Therefore, permanent sprinkler measures were not evaluated.

Table 1-4 summarizes the sample design for PG&E portable sprinkler measures along with the actual number of phone surveys completed, which was stratified by project size. As was the case with pipe insulation, the sample frame includes PG&E portable sprinkler participants from program year 2013 and the first two quarters of 2014 to increase the sample frame (population) from which the sample was drawn. The sample design of 20 completed phone surveys was expected to achieve in the neighborhood of a 90/15 relative precision, based on an expected COV of 0.30, based on the results of the 2010-12 Nonresidential Downstream Lighting Impact Evaluation NTGR results.

[6] The total sums to 99% because SDG&E is not included in the sample design and represents 1% of savings.

Table 1-4: Sprinkler Sample Design and Achieved Data Collection by Project Size

Project Size (kWh)	Percent Ex-Ante Savings	Population	Sample Design	Actual Completed Surveys
> 700,000	43%	8	8	7
250,000 - 700,000	30%	16	6	9
< 250,000	27%	45	6	19
Total	**100%**	**69**	**20**	**35**

We were much more successful in reaching the sprinkler population, with 35 of the 69 participants agreeing to conduct a phone survey. This much higher than expected sampling rate represented half of the sites in the population and 67% of the claimed kWh and kW ex ante savings. Furthermore, the ex-post NTGR was measured at a relative precision of 90/12 which exceeded the target.

1.4 NTG Evaluation Methodology

For program year 2013, the approach for estimating net-to-gross ratios (NTGRs) was based on the same approach utilized for the 2010-12 Nonresidential Downstream Lighting Impact Evaluation[7], which relied solely on participant phone survey data. The NTGR methodology utilized for the 2010-12 Nonresidential Downstream Lighting Impact Evaluation was based on the large non-residential free ridership approach developed by the Net-to-Gross Ratio (NTGR) Working Group and documented in Appendix C of that report, Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Non-residential Customers. The NTGR is calculated as the average of three program attribution indices (PAI) known as PAI-1, PAI-2, and PAI-3. Each of these scores represents the highest response or the average of several responses given to one or more questions about the decision to install a program measure. The participant phone survey was the basis for the inputs to each score.

- **Program attribution index 1 (PAI–1)** is a score that reflects the influence of the most important of various program-related elements in the customer's decision to select a given program measure. The PAI-1 score is calculated as the highest program influence factor divided by the sum of the highest program influence factor and the highest non-program influence factor. Some example non-program factors are: previous experience with the measure, recommendation from an engineer, standard practice, corporate policy, compliance with rules or regulations, organizational maintenance or equipment replacement policies and "other – specify." Payback is treated as a program influence factor if the rebate/incentives played a major role in meeting payback criteria, but is

[7] http://www.energydataweb.com/cpuc/deliverableView.aspx?did=1155&uid=0&tid=0&cid=

treated as a non-program influence factor if it did not play a major role in meeting payback criteria.

- **Program attribution index 2 (PAI–2)** is a score that captures the perceived importance of program factors (including rebate/incentives, recommendation, and training) relative to non-program factors in the decision to implement the specific measure that was eventually adopted or installed. This score is determined by asking respondents to assign importance values to the program and most important non-program influences so that the two total 10. The program influence score is adjusted (i.e., divided by 2) if respondents had made the decision to install the measure before learning about the program. The final score is divided by 10 to be put into decimal form, thus making it consistent with PAI-1.
- **Program attribution index 3 (PAI–3)** is a score that captures the likelihood of various actions the customer might have taken at the given time and in the future if the program had not been available (the counterfactual). This score is calculated as 10 minus the likelihood that the respondent would have installed the same measure in the absence of the program. The final score is divided by 10 to put into decimal form, thus making it consistent with PAI-1 and PAI-2.

The NTGR was estimated as an average of these three scores. If one of the scores was not available (generally due to respondents giving a "don't know" or "refusal" response), then the NTGR was estimated as the average of the two available score. If two or more scores were missing, results were discarded from the calculation.

1.5 Results

This section presents the final results for the 2013 Nonresidential Downstream Deemed Impact Evaluation for sprinkler and pipe insulation measures. Presented are the NTGRs that will be applied to ex-ante first year and lifecycle gross savings values. Also presented are the resulting statewide nonresidential downstream ex-post population-level net savings for first year and lifecycle kW, kWh and Therms. The net realization rates are also provided for first year and lifecycle savings values, which is the ratio between ex-post and ex-ante savings.

Net-to-Gross Ratios

Table 1-5 presents the ex-ante and ex-post NTGR values weighted by ex-ante kWh, kW and therm savings. Recall that only hot applications were evaluated for pipe insulation, so only therm based NTGRs were developed.

Overall, at the statewide level, the ex-post NTGRs are very similar to ex-ante for pipe insulation, and about two-thirds that of the ex-ante values for sprinklers. The relatively low NTGR for sprinkler measures is validated by a number of respondents that claimed they would have

installed the measure in the absence of the program. One of the most influential reasons why the measure was installed was because the sprinklers were better for the participant's crops, which was stated by nearly a quarter of the respondents.

Table 1-5: Ex-Ante and Ex-Post NTGRs by Measure, Weighted by Ex Ante Therms, kWh and kW Savings

Measure	n	Weight	Ex-Ante NTGR	Ex-Post NTGR	Relative Precision
Pipe Insulation	18	Therms	0.60	0.56	16%
Sprinklers	35	kWh	0.60	0.38	12%
Sprinklers	35	kW	0.60	0.38	12%

1.6 Net First Year and Lifecycle Realization Rates

Ex-post net first year and lifecycle savings values were estimated by multiplying the corresponding NTGR by the ex-ante gross first year and lifecycle savings values.

Table 1-6 through Table 1-8 present the first year and lifecycle ex-post and ex-ante savings, and the corresponding net realization rates by PA for the hot application pipe insulation and portable sprinkler measures. The savings values shown represent the entire population of participants that correspond to specific measures evaluated.

Table 1-6: Pipe Insulation First Year and Lifecycle Net Realization Rates for Therm Savings by PA - Hot Application Only

	First Year Therm Savings			Lifecycle Therm Savings		
Program Administrator	Ex-Ante Net Savings	Ex-Post Net Savings	NRR	Ex-Ante Net Savings	Ex-Post Net Savings	NRR
PG&E	124,499	115,402	93%	1,867,486	1,731,035	93%
SCG	601,419	557,475	93%	6,615,606	6,132,224	93%
Statewide	**725,918**	**672,877**	**93%**	**8,483,093**	**7,863,259**	**93%**

Table 1-7: Sprinkler First Year and Lifecycle Net Realization Rates for kWh Savings by PA – Portable Applications Only

Program Administrator	First Year kWh Savings			Lifecycle kWh Savings		
	Ex-Ante Net Savings	Ex-Post Net Savings	NRR	Ex-Ante Net Savings	Ex-Post Net Savings	NRR
PG&E	12,541,831	7,919,107	63%	37,625,494	23,757,320	63%

Table 1-8: Sprinkler First Year and Lifecycle Net Realization Rates for kW Savings by PA – Portable Applications Only

Program Administrator	First Year kW Savings			Lifecycle kW Savings		
	Ex-Ante Net Savings	Ex-Post Net Savings	NRR	Ex-Ante Net Savings	Ex-Post Net Savings	NRR
PG&E	11,588	7,316	63%	34,764	21,948	63%

Because the ex ante gross savings values are passed through, the NRRs are equal to the ratio of the ex post to ex ante NTGRs. The resulting NRR for hot application pipe insulation is 93%, but only 63% for portable sprinkler measures.